

GAO

Report to the Honorable Nunzio J.
Palladino,
Chairman, Nuclear Regulatory
Commission

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NUCLEAR REGULATION

Oversight of Quality Assurance at Nuclear Power Plants Needs Improvement



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The Honorable Nunzio J. Palladino
Chairman, Nuclear Regulatory Commission

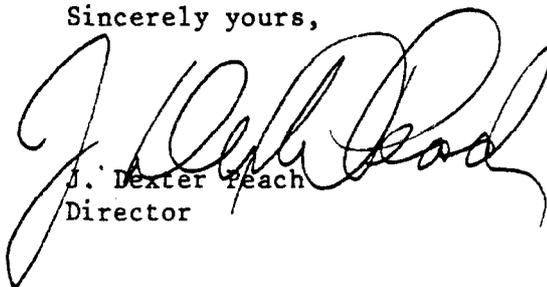
Dear Dr. Palladino:

This report assesses the Nuclear Regulatory Commission's oversight of operating nuclear power plant quality assurance programs. We conducted this review because of the important link between quality assurance and safe plant operations.

This report contains recommendations to you in chapter 2. As you know, 31 U.S.C 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are also sending 25 copies of the report to the Commission's Office of the Executive Director for Operations. In addition, copies of this report are being sent to interested committees of the Congress and the Director, Office of Management and Budget. Copies of the report will be made available to the public upon request.

Sincerely yours,



J. Dexter Teach
Director

Executive Summary

The Nuclear Regulatory Commission (NRC) requires utilities operating nuclear power plants to have quality assurance programs in place so that safety equipment functions properly when called upon. The programs are a collection of management controls, policies, and procedures designed to minimize human errors and equipment problems that could jeopardize safety. Since the 1979 accident at Three Mile Island, however, there have been 40 incidents with safety implications serious enough to be reported, as required by law, to the Congress.

Because of the important link between quality assurance and safe plant operations, GAO reviewed NRC's efforts to

- identify declining performance trends in the operation of nuclear plants that indicate the need for corrective action by utilities and
- require utilities to upgrade quality assurance programs when deficiencies are observed.

Background

In 1983 the Congress, concerned about nuclear plant construction quality, directed NRC to study quality assurance at plants under construction. In its study, NRC concluded that the basic cause of construction quality problems was insufficient utility management attention to important project details. The agency also concluded that neither it nor utilities had quickly identified and corrected the root causes of problems.

Subsequently, NRC determined that many of the study conclusions also applied to operating nuclear plants. Ninety-three operating nuclear plants provide approximately 15 percent of the nation's electricity, and over 100 plants may be in service by the end of the decade.

About once each year since 1980, NRC has systematically assessed each utility's overall operating performance. These assessments, conducted by regional NRC inspection offices, are NRC's principal tool for identifying areas, such as maintenance or fire protection, in need of additional utility and NRC attention. Because the work of regional inspection offices has primarily involved inspecting plants for compliance with NRC's regulations, the principal source of information used in the assessments is inspections results.

On the basis of these assessments and NRC's routine oversight of utility efforts to correct identified weaknesses, NRC has required 12 utilities to develop and implement programs to upgrade management of their

plants. NRC believed that these utilities had experienced breakdowns in management controls serious enough to warrant improvements beyond the immediate correction of problems identified in NRC inspections.

Results in Brief

NRC's assessments have provided the agency and utilities with a useful perspective on the total operational effectiveness of plants. However, they are limited in scope to information that NRC collects through compliance inspections and other regulatory activities. They could be more useful in promoting early detection of utility management weaknesses if the agency expanded the analyses performed in the assessment process and the way the assessment reports are used. Specifically, NRC should

- provide guidance to help it decide when a major upgrading of a utility's management performance is needed,
- analyze assessments over many years to gain a perspective on declining utility performance, and
- include commonly accepted industry measures of plant operating performance in its assessments.

Principal Findings

Program Criteria Needed

NRC decisions to require 12 utilities to upgrade their management capabilities and performance generally followed either extended periods with numerous inspection violations, safety-threatening equipment failures, or both. These decisions were made by various NRC headquarters and regional offices. GAO's analysis showed that the decisions were not made on a consistent basis because of the discretionary authority granted to regional offices and the lack of criteria to guide decision makers. For example, NRC required 5 of the 12 utilities to make major improvements based on marginal performance evaluations over one to four assessment periods. These improvements generally included organizational changes, revised management controls, and measures designed to correct specific weaknesses. However, NRC did not require such improvements at other plants with similar evaluations. Establishing criteria requiring NRC to mandate improvement programs or document why they are not warranted could assist the agency in earlier detection and correction of major utility management weaknesses. (See p. 16.)

Increased Trend Analyses Could Identify Weak Areas

There are two sources of information available to NRC that provide an indication of a utility's management performance—its assessments, which have traditionally measured a utility's success in meeting regulatory requirements, and plant operating data, which reflects how well the utility operates its plant from an engineering perspective.

NRC uses individual assessment reports, which are issued every 12 to 18 months, as one basis for identifying utility management weaknesses and obtaining corrective actions. It could improve these efforts by analyzing the results of assessments over a number of years. For example, analysis of assessment results in ten technical review areas that NRC considers—such as maintenance—can help determine whether current utility performance is improving, declining, or constant. GAO's analysis of assessment reports on 52 nuclear stations, for example, showed that at 9 stations, utility performance in one or more areas declined from highly effective to minimally acceptable over a period of three to four assessments. NRC targeted three of these facilities for extensive management improvements. (See p. 25.)

Plant operating data available to NRC could provide an additional perspective regarding the operation of nuclear plants. NRC collects and publishes information that summarizes how efficiently each nuclear plant operates, as well as the types of safety or operating incidents that occur during operation. NRC's regional offices could gain a more accurate picture of how well a utility operates its nuclear plant by including these kinds of data in their periodic assessments. NRC has not included this data in assessments because it has traditionally emphasized the collection and analysis of data related to compliance with regulations. (See p. 27.)

Recommendations

To further enhance NRC's ongoing efforts to improve the quality of operations at nuclear power plants, GAO recommends, among other things, that the Chairman, NRC,

- establish criteria that would, when met, require NRC to either mandate a utility management improvement program or document the reasons why a program is not warranted,
- analyze historical data in the periodic assessments, and
- expand the information analyzed during systematic assessments to include data on the operating performance of nuclear power plants. (See p. 35.)

Agency Comments

NRC did not comment on GAO's specific recommendations to improve its power plant assessment and management improvement efforts. However, NRC said the report highlighted several areas in which additional work may be desirable. The agency stated that it has begun to change its traditional inspection program to recognize that utilities need to do more than meet minimum regulatory requirements. It also provided additional information on several recent NRC initiatives to collect, analyze, and report statistical trends in certain types of operating data reported by utilities.

The full text of NRC's comments is included as appendix IV. (See p. 51.)

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Abbreviations

GAO	General Accounting Office
NRC	Nuclear Regulatory Commission
QA	quality assurance
RCED	Resources, Community, and Economic Development Division
SALP	Systematic Assessment of Licensee Performance
TVA	Tennessee Valley Authority

Introduction

The use of uranium fuel to create steam and generate electricity represents an updating of the approach used by utilities to produce electricity that has existed since the birth of the commercial utility industry. Before uranium was used as a fuel source, steam needed to drive the electricity generator was created by heating water primarily using coal, natural gas, or oil. Utilities were primarily concerned with assuring that their fossil-fueled plants operated efficiently and economically. With the development and use of nuclear power plants, utilities attempted to generate larger amounts of electricity more economically and with fewer visible environmental effects. Because of the complex engineering of nuclear power plants, however, this brought with it a greater potential for power plant accidents, public health and safety threats that were significant but not well understood, and higher capital costs of building nuclear plants. In comparison with fossil units, nuclear power plants require greater utility management attention to design, construct, and operate safe and efficient facilities.

The Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 *et. seq.*) made utilities primarily responsible for properly building and safely operating nuclear power plants. Because of the attendant safety concerns, regulations governing construction and operation of these facilities have been in place since the introduction of commercial nuclear power. Until January 19, 1975, the Atomic Energy Commission both developed and regulated commercial nuclear power. Effective on that date, that commission was abolished, and its nuclear regulatory responsibilities were assigned to the Nuclear Regulatory Commission (NRC).¹

The Role of Quality Assurance

Because nuclear power is a complex and potentially hazardous technology, assuring quality in the design, construction, and operation of nuclear facilities has been both a long-standing objective and area of concern. Since 1970 utilities building and operating nuclear facilities have been required to adopt quality assurance programs for certain plant structures, systems, and components. The concept of quality assurance is not new. In an industrial setting, it is a term for a collection of policies and procedures designed to minimize human error, equipment malfunctions, and other mistakes. It is also a management control system of programs and predetermined standards that can be used to obtain feedback on how well objectives are being met.

¹Energy Reorganization Act of 1974, Title II, 42 U.S.C. 5841-5851. See also Executive Order Number 11834, 40 Federal Register 2971 (1975).

In a broad sense, quality assurance includes all utility activities related to building and operating a nuclear power plant. In a more narrow legal sense, it pertains to those utility programs and activities required by NRC's quality assurance regulations. Those regulations require utilities to have quality assurance programs that effectively assure utility management that safety-related power plant equipment, systems, and activities work as intended.

Throughout the 1970's NRC emphasized the development and implementation of utility quality assurance programs that were expected to ensure that all aspects of nuclear power plant design, construction, and operations were properly conducted in accordance with NRC's regulations. This included all facets of utility operations, from preparation of detailed design drawings, through the pouring of concrete and the welding of structures at construction sites, to operational activities such as the training of plant operators.

Experiences since 1970, however, have repeatedly demonstrated the difficult challenge of achieving a high level of quality in nuclear power plant design, construction, and operations. The most serious and widely publicized example was the March 1979 accident at the Three Mile Island Unit 2 plant near Harrisburg, Pennsylvania. At that plant, a minor component malfunction cascaded into a series of events that severely damaged the plant's nuclear reactor and released traces of radioactive gases into the environment. Subsequent NRC and independent investigations of the accident identified numerous problems in such areas as nuclear plant operational safety, design and site selection, emergency organization, and management.

Since that accident, 40 other incidents have occurred at 33 nuclear power plant stations that have been serious enough for NRC to report them to the Congress as "abnormal occurrences."² Examples include the recurring failure, in February 1983, of an automatic safety system at the Salem, New Jersey, plant to shut down the reactor when called upon because the system's equipment had not been properly maintained; and the April 1983 discovery that a facility in Florida had unknowingly operated for 5 days with a backup safety system turned off. A June 1985 incident at the Davis-Besse plant in Ohio was very similar to the

²The Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event that NRC determines to be significant from the standpoint of public health or safety. The act requires NRC to make a quarterly report of such events to the Congress.

early stages of the Three Mile Island accident. NRC has tentatively classified this incident as an abnormal occurrence.

Concern Over Construction Quality Assurance

Between 1978 and 1983 major questions regarding the adequacy of construction and the time taken by utilities and NRC to detect and correct unacceptable construction work surfaced at five nuclear projects. For example, in 1981 NRC suspended the 2-month-old operating license at the Pacific Gas and Electric Company's Diablo Canyon Unit 1 after the utility discovered that part of the facility had been built using the wrong blueprints.

The concerns regarding the quality of nuclear power plant construction prompted the Congress to direct NRC to study existing and alternative approaches for improving quality and quality assurance activities at construction sites. NRC's study, commonly referred to as the "Ford Amendment" study after its principal sponsor, Senator Wendell Ford of Kentucky, was conducted between November 1982 and April 1984, and included the development of six case studies of nuclear power plant construction projects that either had experienced or did not have major quality-related problems.

The study led NRC to conclude that the root cause of the major quality-related problems in nuclear power plant design and construction was "... the failure or inability of some utility management to effectively implement a management system that ensured adequate control over all aspects of the project." In many cases, NRC said utility management responsible for the projects was not sufficiently involved or aware of the problems early enough to correct them easily.

The Ford Amendment also required NRC to be introspective and assess potential improvements in its own regulatory functions. On the basis of the study, NRC concluded that its practices had contributed to the development and untimely detection of many utility problems. NRC acknowledged that it (1) had not adequately screened utilities applying for construction permits to identify those that did not have the management skills and capability to complete the projects, (2) had been slow to synthesize scattered quality-related inspection findings developed over a period of years that were indicative of quality breakdowns at the projects, and (3) had set the threshold for acting on construction problems higher than for problems at operating plants because of the absence of an immediate threat to public health and safety at construction projects.

Recent Quality Assurance Developments

In response to the numerous recommendations made in the investigations following the Three Mile Island accident, beginning in 1980 NRC developed and implemented its Systematic Assessment of Licensee Performance (SALP) program. This initiative was designed to provide NRC with two important diagnostic capabilities: a periodic assessment of the performance of each utility building or operating a nuclear power plant, and an aid to allocating its inspection resources among nuclear facilities. NRC initially planned to assess the performance of each utility twice a year, but due to resource limitations it extended the time interval between assessments to 12 months and, in March 1984, to a maximum of 18 months.

An assessment report is prepared for each nuclear power station by a multidisciplinary NRC assessment board comprised of regional inspectors and management officials, and headquarters staff who are knowledgeable about individual plants. The principal source of information used in the assessments is the inspections conducted during the assessment period to determine utility compliance with NRC regulations. Inspectors assigned to power plants, called resident inspectors, and inspectors from NRC regional offices who inspect specialized areas of power plant activities selectively examine utilities' management controls, operating equipment, and safety systems to ensure that utilities comply with regulations and operating license commitments. Other information considered by the assessment boards includes events that occur at the station (particularly those events resulting in one or more plants at the station being shut down) that, as required by NRC's regulations, are reported to NRC; the results of the prior assessment; and the general knowledge of the resident inspector(s) and the board members.

NRC has also taken significant action to respond to the observations and recommendations of its Ford Amendment study. It has accelerated its emphasis on improving utility management capabilities and commitment to quality in nuclear plant construction and operations and has attempted to enhance its own ability to detect and correct major utility problems in a timely manner. In February 1985 NRC issued a program plan for implementing the recommendations of the study. Although the primary emphasis of the study had been on design and construction, NRC concluded that many of the recommendations also apply to operating plants. Therefore, the new quality assurance program plan describes planned improvements that will

- more clearly emphasize to senior utility management the importance of effective and visible involvement in quality-related programs,

- enhance NRC's and utilities' capabilities to identify trends in day-to-day utility performance and diagnose major problems before they escalate into safety-threatening incidents,
- expand and focus NRC's capability to evaluate the performance of utility management, and
- clarify NRC's quality-related standards and guidance.

NRC's program plan is heavily oriented toward motivating, improving, and evaluating utility management to achieve the desired end result—quality design, construction, and operation of nuclear power plants. According to the plan, utility management is an area in which NRC traditionally has not had significant involvement. NRC decisions and judgments on management issues have been inherently more subjective than the detailed engineering analyses and inspections for compliance with NRC regulations that have traditionally been the cornerstone of nuclear power regulation.

NRC's periodic assessments of utility performance, mentioned earlier, play an important role in NRC's planned actions. In their current form, the assessments indirectly evaluate utility management performance by considering the results of NRC inspections. To date, NRC inspections and assessments have focused on utility violations of NRC regulations that have real or potential safety implications. According to its new program plan, NRC would continue to use these regulations as its basic criteria for assessing utility activities. However, the plan calls for NRC to increase its inspection and assessment emphasis on those inspection violations with real—rather than potential—safety implications. The plan also calls for NRC to evaluate alternatives, such as directly inspecting utility management activities or developing management performance indicators, for directly evaluating management performance.

Objectives, Scope, and Methodology

Our objective was to identify opportunities for improving NRC's operating nuclear power plant quality assurance activities. Initially, we focused our review on NRC's quality assurance-related licensing and inspection activities at operating reactors and its efforts to improve operations at recognized problem plants. We focused on NRC's regulation of operating nuclear plants because of the increasing number of these plants and because of NRC's then ongoing study of construction-related quality assurance. As of September 30, 1985, NRC had licensed 93 power plants to operate in the United States. By the end of the decade, over 100 power plants could be in service.

Consistent with the emphasis that NRC's February 1985 quality assurance program plan places on utility management performance and improving NRC capability to detect utility problems, we focused our work on NRC's use of readily available information to assess and improve utility management and overall performance at these facilities. Further, because NRC's periodic assessment of each licensee's performance is its formal tool for appraising utility performance, including the performance of utility management, we concentrated on this assessment process.

To gain an understanding of NRC's process, we reviewed written assessment procedures and interviewed officials at NRC's Office of Inspection and Enforcement, Bethesda, Maryland, and inspection officials at NRC's regional offices in Atlanta, Georgia, and King of Prussia, Pennsylvania. Together, these two regional offices are responsible for inspecting and assessing 53 of the 93 nuclear power plants licensed to operate by September 1985, when we completed our review.

To determine if NRC's periodic assessments provided information that NRC could use to develop performance trends that could enhance the thoroughness of its assessments, we collected all assessment report results for the period 1980 (when NRC began its assessment program) through June 1985. We then analyzed this information by plant, by NRC region, and on an industry-wide basis to develop historical plant, regional, and industry-wide trends.

To determine if other nuclear power plant operational data exists that NRC might use to provide additional insights into the effectiveness of utilities' performance in operating their plants, we interviewed NRC inspection and enforcement officials and reviewed NRC publications pertaining to nuclear power plant operations.

Finally, to determine how NRC identifies operating nuclear power plants with major operational problems and reaches agreement with the affected utilities on specific improvements, we supplemented our analysis of historical assessment results with a detailed review of the inspection history of four plants. The plants were the Maine Yankee plant in Maine, the Pilgrim Unit 1 plant in Massachusetts, the Brunswick Units 1 and 2 plants in North Carolina, and the Browns Ferry Units 1, 2, and 3 plants in Alabama. We selected these plants based on discussions with NRC inspection officials who identified them as plants that had experienced major quality-related problems since 1980.

We used information from several sources to supplement these efforts. To observe the complexities of quality assurance firsthand, we observed NRC quality assurance inspections and met with executives from the nuclear industry's Institute of Nuclear Power Operations and with corporate and power plant officials from Florida Power and Light Company. We also visited ten nuclear power plants and discussed quality assurance matters with plant- and corporate-level utility officials. These plants are listed in appendix III.

We conducted our review between September 1983 and September 1985 in accordance with generally accepted government auditing standards.

Opportunities to Improve Assessments of Utilities' Performance

NRC's systematic assessment program is an integral part of its effort to promptly identify utilities experiencing quality-related problems. Its assessment reports synthesize the results of its inspections and interactions with utility staffs engaged in operating, maintaining, refueling, and other types of day-to-day power plant activities. These periodic reports become the basis for meetings with utility management, additional inspections, and review and approval of utility plans to correct identified weaknesses. At 12 facilities over the last 4 years, however, NRC decision makers have taken the additional step of requiring a utility to develop and implement a program to upgrade the quality of its nuclear plant management that went beyond the correction of specific procedural or equipment deficiencies identified through NRC inspections.

NRC can improve its use of systematic assessments to identify plants that may need significant management improvements by establishing assessment-related criteria that would, when met, require the agency to either mandate improvement programs or document the reasons why they are not warranted. For example, such criteria might include the number and types of assessment areas in which NRC has rated the utility's performance at a facility "minimally acceptable," the length of time the utility has been experiencing serious problems, and the apparent success of a utility's recent efforts to improve its overall performance.

NRC can make other improvements in its assessments that are consistent with its new emphasis on early detection of management weaknesses. Specifically, the agency can enhance its ability to identify relatively strong and weak utility performance in various technical areas by

- analyzing historical assessment results in various technical performance areas,
- considering readily available information on plant operating performance in its periodic assessments, and
- considering its findings in technical performance areas such as maintenance and operations as a part of its assessment of a utility's performance in the area of quality assurance and administrative controls.

Utility Improvement Program Criteria Needed

Between March 1981 and March 1985 NRC's headquarters division directors and regional office administrators required a total of 12 utilities to develop and implement programs to correct management deficiencies identified in the utilities' operation of their nuclear plants. Some of the programs were ordered on the basis of weaknesses that NRC identified

during its investigations of safety-related plant events. Others were required on the basis of plant inspection and assessment results obtained by NRC over several years. Program scope went beyond the correction of specific problems or weaknesses identified through NRC inspections or assessments in an effort to generally upgrade the affected utilities' performance. Appendix I identifies the 12 nuclear stations and summarizes the reasons why NRC required improvement programs at them.

The 12 management improvement programs were required by either NRC's Director, Office of Inspection and Enforcement, its Director of Nuclear Reactor Regulations, or the NRC regional administrator responsible for inspecting and periodically assessing the affected plants. According to NRC's Director, Division of Inspection Programs, Office of Inspection and Enforcement, NRC regional administrators generally have the prerogative of deciding when these improvement programs are necessary. This is consistent with NRC's decentralized organizational structure and regulatory philosophy, in which each of its five regions is responsible for certain aspects of licensing, inspection, and enforcement for each facility located within its assigned geographical area.

According to the Director of NRC's Division of Inspection Programs, NRC's decisions can be based on a variety of factors. Although there are no official criteria to guide headquarters and regional decision makers, the factors considered include a plant's history of events, NRC's assessment ratings for the critical plant operations technical area, its overall assessment trends, and the utility's responsiveness to NRC suggestions for improvement. In essence, NRC can require these programs whenever it believes they are necessary.

The absence of criteria to guide NRC in considering the need for major utility improvement initiatives appears to have contributed to inconsistency in how NRC decided to address problems at operating nuclear power stations. Our analysis of historical systematic assessment ratings, for example, revealed apparent inconsistencies in NRC's consideration of:

- The length of time utility performance in one or more technical areas has been rated minimally acceptable. Some utilities with marginal performance in one or two assessment periods were required to implement major improvement programs, while other utilities with three consecutive marginal performance assessments were not.
- The scope of utility improvement programs required by NRC. In similar circumstances NRC sometimes required broad management improvement

programs, while at other times required programs focused only on improving performance in a specific technical area.

- The combination of technical areas that, when assigned marginal performance ratings, indicates the need for major utility management improvement programs.

The following sections provide examples of these inconsistencies.

NRC's Assessments Identify a Utility's Strengths and Weaknesses

For each of the 12 operating nuclear power stations with an NRC-mandated management improvement program, NRC had prepared systematic assessment reports evaluating the utility's strengths and weaknesses in some or all of ten technical areas. Conceptually, the ten areas apply to each operating nuclear power plant. However, an NRC assessment board evaluating a specific facility's performance may decide not to address one or more of the areas because sufficient information is not available to develop a valid assessment. This could occur, among other reasons, because of limited NRC inspection efforts in a technical area or the status of the power plant during the assessment period.

The technical areas have been changed somewhat by NRC since it began the systematic assessment program in 1980. As of March 1984, however, each formal assessment of a utility's operating performance considers some or all of these ten technical areas:

- Plant operations: training and day-to-day activities of a facility's control room operators, shift technical advisers, and auxiliary equipment operators.
- Radiological controls: controls for protecting workers and equipment from unnecessary exposure to radiation.
- Maintenance: all preventive and corrective maintenance activities.
- Surveillance: tests and inspections of equipment and buildings to ensure that systems are working, or ready to work, as intended.
- Fire protection: staffing and training of fire protection units, maintenance and readiness of protective systems, and fire-prevention programs.
- Emergency preparedness: preparation for and performance during joint utility, state, and local government tests of simulated nuclear power plant accidents, and the status of equipment, staff, and procedures needed to respond to and recover from such accidents.
- Security: activities to control access to sensitive areas of the power plant and protect the facility.

- Refueling: the procedures used by a utility to replace used fuel in the reactor with new fuel and to remove and store the used fuel.
- Quality program and administrative controls: all verification and oversight activities that assure or affect the quality of nuclear power station activities.
- Licensing activities: preparation of amendments to the facility's operating license and responses to NRC licensing changes.

NRC has not assigned any relative ranking, denoting importance to safety or effective plant operations, to the ten technical areas. However, NRC inspection program officials responsible for oversight of the systematic assessment program stated that the plant operations area is generally regarded as a very critical area.

For each technical area, the NRC performance assessment board assigns a numerical rating of either 1, 2, or 3. According to NRC, a rating of 1 denotes an aggressive and safety-oriented utility management that effectively allocates resources to achieve a high level of safety. It also suggests that future NRC inspection coverage in the area can be reduced. A rating of 2 means that utility management attention to safety is sufficient to achieve a satisfactory level of safety and that NRC attention should be maintained at a normal level. A rating of 3 indicates that, although the utility is meeting regulatory standards, overall performance in a technical area is marginally satisfactory, and both utility management and NRC should increase their attention to the area.

On the basis of the ratings in each technical area, and in comparison with the ratings shown in the previous assessment report, NRC's boards judge whether the observed performance indicates that a utility is experiencing fundamental regulatory-related problems that NRC and utility management should address. The boards report their numerical ratings, supporting analyses, and recommendations for action to the NRC regional administrator responsible for inspecting the nuclear power station. The regional administrator then transmits the report to the utility's top management and requests the utility's comments on the report. Report copies are provided to NRC's Office of Inspection and Enforcement, which develops assessment policy guidelines and monitors the program's implementation, and to other NRC offices. Copies are also placed in NRC's public document rooms for public examination, as are copies of the utility's comments on the reports.

For 5 of the 12 stations with NRC-mandated improvement programs, NRC's orders and letters requiring the programs specifically referred to

prior marginal performance assessments. For example, NRC's July 1984 order requiring the Tennessee Valley Authority (TVA) to improve management of its Browns Ferry station was the culmination of over 3 years of recurring NRC inspection violations and marginal performance assessment results. The continuing violations and low assessments over several years led NRC's regional office to conclude that TVA management had not understood and corrected the underlying management deficiencies that had caused the recurring problems.

For the remaining seven stations with NRC-mandated programs, NRC's orders and letter referred to specific events or the results of recent inspections. NRC's December 1982 order to the Carolina Power and Light Company to improve management and operations of the Brunswick nuclear power station is typical of the circumstances leading to these NRC decisions. In this case, the order came after (1) an NRC inspection of the causes for a June 1982 unplanned reactor shutdown determined that the utility had not properly monitored or maintained certain safety systems during the station's more than 7 years of operation and (2) subsequent inspections revealed that the utility was not effectively implementing new commitments to improve its handling of technical problems. (App. II provides additional details on Browns Ferry and Brunswick and two other nuclear stations that NRC officials found had experienced major management and quality assurance problems.)

Inconsistency in the Duration of Marginal Utility Performance

On the basis of NRC's assessment ratings over a period of several years, there appears to be an inconsistency in how long NRC will permit minimally acceptable performance before requiring major utility performance improvement initiatives.

For 11 of the 12 cases, NRC ordered improvement programs after minimally acceptable assessments covering from one to four assessment periods. In one case, NRC had not assigned a minimally acceptable performance rating to any technical area prior to ordering the improvement program. On the other hand, NRC assessment boards had assigned minimally acceptable or progressively declining performance ratings in a technical area for at least three assessment periods at nine other nuclear power stations, but NRC had not ordered utilities to implement management improvement programs.

The apparent inconsistency may be explained on the basis of the detailed performance history at each plant or on each regional administrator's perception of specific performance problems. However, if NRC

established a time-related criterion for formally considering whether minimally acceptable performance in one or more technical areas warranted a major utility performance improvement program, the added discipline that this would bring to NRC's oversight of these utilities could, we believe, help NRC achieve its objective of timely detection and correction of quality-related problems at operating nuclear power plants.

Inconsistency in the Scope of Improvement Programs

As illustrated in table 2.1, assessment reports completed by NRC before it ordered broad improvement programs at the 12 operating nuclear stations show that in 3 of the 12 cases NRC assessment boards assigned utilities minimally acceptable performance ratings in only one of the ten technical assessment areas. On the other hand, two other nuclear stations each received a minimally acceptable rating in two technical areas during the most recent assessment period but were required by NRC to implement improvement programs limited in scope to a particular technical area. Although an unacceptable personnel exposure to radiation at each facility triggered NRC's action, the minimally acceptable assessment rating for these facilities was similar to the assessment results at 3 of the 12 facilities that NRC required to implement broad improvement programs.

As with the length of time utilities operate with minimally acceptable performance, NRC may need criteria to assist it in determining the scope of utility improvement programs that are required to upgrade the utility's performance.

**Chapter 2
Opportunities to Improve Assessments of
Utilities' Performance**

Table 2.1: Minimally Acceptable Performance Areas for Stations With Improvement Programs^a

Facility	Assessment area rated minimally acceptable prior to program
Browns Ferry	Operations Radiological controls Maintenance Security Refueling Quality programs
Brunswick	Operations Radiological controls Maintenance Fire protection Quality programs
Duane Arnold	Radiological controls Emergency preparedness Refueling
Palisades	Operations Radiological controls Surveillance
Pilgrim	Operations Maintenance Quality programs
D.C. Cook	Emergency preparedness Fire protection
Fort St. Vrain	Operations Licensing
La Crosse	Operations Emergency preparedness
Cooper	Emergency preparedness
Davis-Besse	Maintenance
Turkey Point	Operations
Nine Mile Point	None

^aBased on ratings contained in the last systematic assessment report issued by NRC before it required improvement programs.

Relative Importance of Technical Areas Has Not Been Determined

As shown in table 2.1, 11 of the 12 nuclear power stations with NRC-mandated quality improvement programs had received minimally acceptable assessments in from one to six technical areas that NRC assessed before it ordered the improvement programs. The table also illustrates the variety of combinations of low NRC assessments at these plants. For example, NRC had given the Browns Ferry station minimally acceptable assessments in the technical areas of operations, radiological controls, maintenance, security, refueling, and quality programs before ordering an improvement program at that station. In contrast, at the Cooper station, NRC had assigned a minimally acceptable rating only to the emergency preparedness area. Furthermore, as discussed earlier, our analysis of the assessment ratings for other nuclear power stations

shows that NRC had for several years assigned minimally acceptable or progressively declining performance ratings to various technical areas at nine stations but had not required utilities to implement broad management improvement programs. In two additional cases NRC had required utilities to implement improvement programs limited to one of two technical areas with poor assessments.

The above discussion illustrates the fact that NRC has not established the relative importance of each technical area in the systematic assessment. Without relative agency priorities, NRC headquarters directors and regional administrators are free to decide which assessment performance trends warrant special attention and which do not. Thus, some NRC officials could consider a trend of minimally acceptable performance in the emergency preparedness area as equally important as similar trends in operations, maintenance, and/or quality programs. Others, however, may operate with different views on which technical areas are most important.

NRC also has not established criteria for headquarters and regional officials to use in considering the appropriateness of management improvement programs based on NRC's assessments of a utility's performance in each technical area. Such criteria might include the number and type of assessment areas in which NRC has rated a utility's performance as minimally acceptable, the length of time a utility has been performing at that level, and the utility's progress in improving its performance. In the absence of such criteria, NRC has responded differently to similar utility problems. Its responses have varied from requiring facility-wide management improvements, to requiring improvements in one technical area, to a limited response of discussions with utility management and review of utilities' plans to correct specific weaknesses identified by NRC.

In our discussion of these management improvement program issues with him, NRC's Director of Inspection Programs acknowledged that the agency has responded differently to apparently similar problems at operating power plants. He added that these inconsistencies have been caused in part by NRC's not having uniform criteria to guide its headquarters and regional officials. However, because regional administrators, particularly, are closest to activities and circumstances at individual power plants, the director strongly supports NRC's practice of allowing the administrators to use their discretion in ordering an improvement program. For example, he said administrators should be allowed to consider a utility's current improvement efforts and general

attitude toward NRC suggestions prior to ordering such a program. Thus, although he believed NRC should maximize the consistency with which it orders improvement programs, he suggested that any measure developed to achieve this should be flexible enough to allow regional administrators to continue to use their assessment of intangible conditions and utility attitudes in shaping their final decisions.

We recognize that different NRC responses to problems at different individual nuclear power stations may be appropriate. For example, if a utility has demonstrated that it is responsive to NRC improvement initiatives, informal NRC discussion and monitoring of utility actions to correct problems may be as effective as an NRC-mandated improvement program. The absence of criteria that would require NRC officials to consider the need for improvement programs, however, lessens NRC's assurance that it is giving timely consideration to this key regulatory action. By documenting how they used the criteria, NRC officials would provide agency management with a permanent record of their deliberations concerning specific facilities. NRC management could then use this information to periodically assess the overall effectiveness of its regulatory oversight programs.

Increased Trend Analyses Can Help NRC Assess Utility Strengths and Weaknesses

NRC's quality assurance program plan suggested that increased NRC and utility analyses of power plant trends could help to detect problems quickly that might develop at these facilities. Comparing periodic assessment results over a number of years could also help NRC identify utilities that are consistently experiencing problems before they lead to safety-threatening incidents. These assessment trends would provide NRC with a means of gauging the effectiveness of a utility's efforts to correct or improve facility performance in historically weak technical areas. Such improvement or lack of improvement over time is one indication of a utility's managerial capabilities and its commitment to quality operations.

Early in 1985 NRC's Office of Inspection and Enforcement took a step in this direction by developing an automated data base of all assessment ratings given to each operating plant since the assessment program began in 1980. The office has disseminated these data within NRC's headquarters and regional offices. Inspection office officials told us that the office has not analyzed these assessment scores, such as computing averages or historical trends on a plant or industry basis and used the analyses in the inspection program because it has traditionally held that the primary purpose of the assessment program is to identify power

plant performance problems in individual technical areas. Regional offices' assessment boards compare a plant's rating in each technical area with the rating from the previous report and comment on any observed general changes in the utility's performance during the assessment period. To date, these boards have not included any discussions of performance trends over a longer period.

NRC's periodic assessments provide considerable information to identify utility performance trends in each of the technical areas. For example, analyses of historical trends in each technical area for individual operating facilities can help determine whether performance differences observed from one assessment to the next are a temporary reversal of long-standing conditions, the continuation of previous trends, or possibly the result of a change in NRC inspection emphasis. Although 1 to 2 years of minimally acceptable or declining utility performance in an area suggests the need for improvement, the continuation of such performance over time may also indicate that utility management does not understand or cannot effectively address the root cause of identified problems. To the extent that long-term trends of weak performance are in operational areas, such as plant operations or maintenance, they indicate an increased potential for a major plant incident.

To demonstrate the added information that NRC could obtain from historical assessment results, we analyzed NRC's history of assessment scores from the beginning of the assessment program in 1980 through June 12, 1985, for each technical area at each operating nuclear power station. As summarized in table 2.2, NRC's most recent reports for the 52 operating stations contained 495 ratings for the ten technical areas. (Some technical areas were not assessed at some plants.) Nineteen of these ratings (almost 4 percent) showed a long-term trend of minimally acceptable or declining performance. In ten cases (involving nine facilities), a station's performance in a technical area declined from highly effective (a rating of 1) to minimally acceptable (a rating of 3) over at least three assessment reporting cycles. In nine cases, a station experienced three or more consecutive low ratings. As the table shows, these trends most frequently involved the operations, maintenance, and quality programs technical areas. In total, the 19 instances of minimally acceptable or declining technical performance occurred at 14 nuclear power stations.

Table 2.2: Stations With Marginal or Declining Performance Trends^a

Technical area	Stations rated in most recent report	Consistently marginal ratings^b	Declining performance^c	Total
Operations	52	3	3	6
Radiological controls	52	1	0	1
Maintenance	52	2	1	3
Surveillance	52	0	2	2
Emergency preparedness	52	0	2	2
Fire protection	46	0	0	0
Security	52	0	0	0
Refueling	45	0	0	0
Quality programs	40	3	0	3
Licensing	52	0	2	2
Total	495	9	10	19^d

^aBased on NRC's most recent three to four assessment reports issued between January 1, 1980, and June 12, 1985.

^bDefined by GAO as category 3 ratings in the most recent assessment report and two or more consecutive previous reports.

^cDefined by GAO as a decline in assessment ratings from category 1 to category 3 over a period of at least three assessments.

^dTotal represents 14 nuclear plant stations experiencing trends in one or more assessment areas.

In reviewing these assessments, we observed that 11 nuclear power stations each had one technical area with marginal or declining performance. As summarized in table 2.3, however, three other stations had low performance assessments in two or more technical areas.

Table 2.3: Nuclear Stations With Minimal Performance Trends in Two or More Areas^a

Station	Areas with minimal performance trends
Browns Ferry	Operations Radiological controls Quality programs
Fort St. Vrain	Operations Maintenance Licensing
Davis-Besse	Maintenance Emergency preparedness

^aBased on NRC's most recent three or more assessment reports for each station issued through June 12, 1985.

The three-unit Browns Ferry station experienced continual performance problems over three consecutive assessments in three of the ten technical areas. As discussed earlier in this chapter (and in more detail in app. II), largely on the basis of this assessment record, on July 11, 1984, NRC

required TVA to implement a major multiyear, stationwide improvement program.

In October 1984 NRC referred to the Fort St. Vrain performance assessments when it concluded that the Public Service Company of Colorado should contract for an independent third-party assessment of the station's operation and management before planning and implementing station and company improvements.

At the Toledo Edison Company's Davis-Besse station, an NRC-mandated management improvement program was in progress when, on June 9, 1985, equipment problems in one reactor system led to failure of several other safety systems and the subsequent shutdown of the reactor. NRC has tentatively classified the incident as an abnormal occurrence.

NRC Division of Inspection Programs officials recognized the advantages of routinely analyzing assessment trends. They stated that assessment boards are generally aware of and consider such long-term trends at individual facilities when conducting their assessment deliberations. They agreed, however, that because assessment reports present only the results of the most recent assessments, including any appropriate comparisons between the most recent and immediately previous assessment, readers of the reports are not always aware of historical trends. Further, they agreed that in those cases where a utility has continually received marginal or declining performance ratings, including such historical information in assessment reports can provide a valuable perspective to utility management officials and others interested in the reports—something that is lacking in assessment reports issued to date.

Considering Operational Indicators Can Enhance Assessment Reliability

Defining reliable indicators of plant and utility management performance and collecting the associated information is essential to the improved assessments that NRC's revised quality assurance program plan calls for. Accumulated over several months, information concerning a power plant's operating efficiency and performance can provide general indications of utility managements' broad capability to minimize and respond to human errors, equipment failures, and other operational problems. NRC's assessment program permits boards to develop several indicators of a utility's performance in adhering to NRC's regulations. For example, NRC categorizes each inspection violation it issues into one of five severity levels depending on its actual or potential threat to public health and safety. As indicators of a utility's performance, NRC boards

are permitted to consider the number and the severity levels of violations detected since the previous assessment, as well as the nature and repetitiveness of the more serious violations.

Similarly, boards can consider unplanned reactor events that a utility reports to NRC, particularly the unplanned reactor shutdowns generally known as "scrams," as a general indicator of a utility's success in minimizing safety-related events. To meet NRC regulations, nuclear power plant manufacturers have designed reactors to shut down automatically if problems develop with reactor water cooling systems, equipment used to release pressure within a reactor, or other safety systems. A utility's efforts to properly maintain power plant equipment, use correct reactor operating procedures, and minimize personnel error in all safety-related power plant activities can directly affect the number of times a nuclear plant automatically shuts itself down.

NRC's Office of Resource Management, a staff office of the agency's Executive Director for Operations, collects a variety of information on nuclear power plant operational activities. For example, for each operating nuclear power plant NRC collects and publishes the following information each month:

- the hours the plant operated and the percentage that this represents of the total hours available during the month (known as a plant's "service factor);
- the electricity generated in megawatts and as a percentage of the total electricity the plant is designed to generate (a plant's capacity factor);
- the hours the plant was shut down following discovery of an "off-normal" situation (a "forced outage"), the reasons for and components causing the shutdown, and the corrective actions the utility has taken to prevent the incident from reoccurring; and
- the hours that the plant was available to operate, regardless of the number of hours that a utility actually operated the plant (called a reactor's availability factor).

NRC collects and publishes this information so that agencies and individuals interested in analyzing trends in the nuclear industry that might have safety implications can have this information at their disposal. Other NRC reports summarize plant workers' exposure to radiation and facilities' shipments of radioactive waste to off-site storage. However, NRC does not require regional assessment boards to use these sources of information as input into their assessment deliberations.

Until NRC's Ford Amendment study, NRC had not considered using these types of operational indicators to pinpoint potential utility problems because of its traditional emphasis on a facility's regulatory performance. During meetings addressing this subject, NRC Office of Inspection Programs officials informed us that they have traditionally considered a facility's "availability factor" and other operational statistics as indicative of the power plant's economic performance.

However, according to NRC's Director of Inspection Programs, NRC is beginning to study how to use plant operational indicators to guide its day-to-day inspection efforts. He said that NRC is in the preliminary stages of identifying the indicators it could use to focus inspectors' routine evaluations of power plant activities and incorporating analyses of these indicators into its inspection manual.

NRC's modified inspection approach recognizes that the operational side of a nuclear plant's performance may be linked to its regulatory performance in several ways. Measures such as workers' exposure to radiation are directly related to the effectiveness of a utility's operations in the radiation control technical area. Other measures, such as service, availability, capacity factors, and forced outage rates are intuitively related to nuclear safety. Capacity factors higher than the 57-percent industry average in 1984 generally mean longer than average power plant production runs between shutdowns. Extended periods of continuous operation involve relatively routine operator reactor control activities, less use of redundant plant safety systems, and less opportunity for errors in shutting down and starting up a plant. This in turn reduces the opportunities for minor equipment and human problems to escalate into potentially more serious safety-related events.

Since day-to-day inspections are the basis for NRC's periodic assessments, its efforts in this area could ultimately result in assessments that better reflect facilities' operating conditions and problems. To that extent, these efforts are consistent with our views that operational indicators can provide NRC inspectors with important insights into the quality of utility activities. However, NRC's actions in this area are primarily directed at using these indicators to identify the specific utility activities that NRC inspectors will examine. Although this can improve the overall NRC inspection program, using these operating performance indicators in periodic assessments could also improve the quality of these assessments.

For example, NRC's regional assessment boards could use these readily available indicators of power plants' operating performance in their systematic assessment deliberations to confirm or question the reliability of preliminary assessments primarily on the basis of inspection results, the knowledge that inspectors have of the plant, and reported plant events. For example, analysis indicating that a facility operated at a relatively high capacity would tend to confirm a board's assessment of highly effective utility maintenance and operational activities. Conversely, although a decrease in maintenance or operations-related inspection violations from one assessment to the next might suggest improved utility performance, a relatively low capacity factor might prompt an assessment board to recheck its analyses and preliminary assessments. Further, NRC analysis might reveal that the decrease in violations was more attributable to a decrease in NRC inspection coverage than to improved utility performance.

In most cases, NRC would use several indicators to confirm or reexamine its assessment results. Together, these indicators would present a more complete picture of a utility's activities and could, therefore, increase NRC's confidence in its assessment results.

In commenting on a draft of this report, NRC's Executive Director for Operations described several recent NRC initiatives to improve its collection, analysis, and reporting of safety-related events that occur at operating power plants. According to him, NRC's Office for Analysis and Evaluation of Operational Data has (1) issued two in a series of reports analyzing operating power plants' reactor shutdowns and use of emergency safety systems, (2) begun statistical studies to measure the availability of these systems and trends in NRC violations, (3) standardized utilities' requirements to report events with safety implications to NRC, and (4) started a program to analyze the strengths and weaknesses of these reported events. According to him, these studies are distributed to NRC staff and can be used as input to regional SALP boards' evaluations of a facility's operating performance.

We agree with NRC's Executive Director for Operations that such studies can provide NRC assessment staff with additional insights into the performance of individual facilities. By analyzing the number, type, and relative implications of safety-related events at operating facilities, these studies help measure the effectiveness of utilities' day-to-day efforts to safely operate these facilities. However, these studies focus only on the regulatory side of a utility's performance and do not recognize the additional insights that can be gained from examining trends in

a facility's economic performance. Capacity and availability factors, in-service hours, and other measures of a utility's commercial activity are pragmatic "bottom-line" indicators of companies' strengths and weaknesses operating these facilities. In this sense, they represent an additional source of information that NRC assessment staff can use to supplement the inspection results and NRC staff analyses already available.

NRC Assessments of Utility Quality Assurance Programs Can Be Upgraded

All of the ten technical areas assessed by NRC's periodic assessment program, with the exception of the quality programs and administrative controls area, are first-line operational activities that, in total, make up the day-to-day operation of a nuclear power plant. For example, the maintenance area covers all plant preventive and corrective maintenance, and the surveillance area includes scheduled tests and inspections of plant equipment and buildings to ensure that they are in working order. The quality programs area, however, represents those verification and oversight activities intended to ensure that the activities covered by the other technical areas—such as maintenance and surveillance—are being properly discharged. Thus, a utility's performance in the quality programs area can be an indicator of its management performance.

NRC's Ford Amendment study emphasized that, to be effective, a utility's quality assurance program must have the active and aggressive support of management throughout the company. Stated another way, if a quality assurance program is consistently minimizing problems throughout a large and complex nuclear power plant, then the program's effectiveness is probably due to utility management's commitment to that program.

We found, however, that NRC does not require assessment boards to consider the assessment results in the first-line operational areas as inputs into the appraisal of quality programs.

We reviewed eight assessment reports—at least one for each of NRC's five regional offices—prepared between March 1984, when NRC established quality programs and administrative controls as a technical assessment area, and April 1985. Seven of these reports contained an assessment of the quality programs technical area. In five of the seven cases, the assessment boards evaluated the utilities' performance in the quality area on the basis of the results of quality assurance-related inspections during the periods covered by the assessments. Their reports

commented on such problems as incomplete utility audits of corrective action programs, quality control personnel's inappropriate pre-delivery inspection and acceptance of deficient plant equipment, and failure of a utility's oversight committee to review proposed changes to a facility's electrical system.

In the five cases discussed above, the boards did not explicitly report the utility's performance in the other technical areas in their quality programs assessments. For example, the boards did not discuss in these assessments such problems as improper insertion of reactor control rods, repeated mistakes that rendered essential facility safety systems inoperable, surveillance tests being consistently missed, and a reactor not being shut down as NRC requires when backup electrical equipment fails. The first of these problems was serious enough that NRC classified it as an abnormal occurrence. Yet the quality programs assessments did not reflect the quality assurance weaknesses that contributed to these problems.

For the remaining two assessment reports, the assessment boards elected to consider the utilities' problems in other technical areas as indicators of a quality assurance program's effectiveness. For one facility, the report states that

"The discernible decline in regulatory performance in the areas of operations, radiological controls, maintenance, surveillance, and emergency preparedness demonstrates that administrative [quality] controls have not been effective. . . ."

The other report states that "the NRC has perceived during this assessment period an insufficient degree of involvement of the corporate quality assurance organization in day-to-day plant activities. . . ."

These differences in assessment boards' approaches to quality assurance programs assessments have occurred in part because NRC's assessment procedures are general enough that boards can use either approach. The procedures allow assessment boards to limit their evaluations to utility management's involvement in the quality programs area and the results of NRC quality assurance-related inspections, or to expand their assessments to the entire range of activities in all technical areas. Assessment boards using the more expansive second approach would consider a utility's management involvement and inspection history in each technical area as input into their evaluations of quality assurance performance.

Conclusions

NRC has concluded that the capability and performance of utility management are the most critical factors affecting the quality of nuclear power plant operations. It has also recognized that its traditional emphasis on ensuring utility compliance with the agency's detailed regulations has not provided it with the information it needs to evaluate utility management's performance. Therefore, in February 1985 NRC began to explore ways to improve utility management and the agency's capability to evaluate utility management's performance. For example, NRC will seek ways to improve utilities' and its own capabilities to identify trends in day-to-day performance and diagnose performance problems before they escalate into incidents.

NRC's periodic assessments of each utility's performance in operating its nuclear power station will continue to play an important role in NRC's current initiatives because they provide NRC with a documented basis for discussing with utility management the agency's views on a utility's relative strengths and weaknesses and, where appropriate, the need for major improvements.

We believe that NRC's utility management-oriented approach is a prudent one because it recognizes that, in the final analysis, a utility's performance in individual technical areas largely reflects management's involvement in plant activities. We also believe that NRC's periodic assessments have provided the agency and the utilities with a useful perspective on utility management's performance in operating nuclear power plants.

Nevertheless, the fact that several NRC determinations that major utility management improvements were needed at operating plants came only after the occurrence of safety-related incidents or several years of marginal utility performance illustrates that NRC will need to develop better and more disciplined assessment tools if it is to successfully detect and correct utility performance problems before the problems lead to plant incidents. We have identified four areas where improvements can strengthen NRC assessments.

The lack of systematic assessment-related criteria, first, explains why NRC has not been more active in identifying utility management weaknesses in a timely manner. NRC believes that judgments on the need for and scope of utility management improvement programs are best left to the discretion of regional administrators on the basis of the detailed knowledge of utility management performance that they have traditionally derived from inspections, periodic assessments, plant-operating

experiences, and frequent interactions with utility officials at plant and management levels. We agree that regional administrators may be in the best position to make these judgments. With specific criteria in place, however, regional administrators would retain their discretionary authority, but NRC management would have greater assurance that regional administrators would give timely consideration to the need for utility management improvements at plants with historically poor assessment results. Such criteria would also enhance the consistency of NRC's approach to this important issue.

Systematic assessments are NRC's basic tool for evaluating utility performance. The routine analysis of historical assessment results in each technical area, second, if made an integral part of each periodic assessment and highlighted in assessment reports when a utility has received declining or minimally acceptable ratings in one or more technical performance areas over several assessment periods, would enhance the effectiveness of NRC oversight.

Third, readily available data on plant performance—such as various electricity production-related factors—are not now considered in the systematic assessment process. Such an additional test of the validity of tentative assessment results now largely based on inspections and other regulatory-related information would strengthen assessment quality. NRC's new initiative aimed at incorporating operational indicators into day-to-day inspection planning recognizes that such indicators can provide an important perspective on a utility's overall management of station operations.

The quality programs and administrative controls area involves verification and oversight of operational activities that comprise the other nine technical areas; assessment results in those areas could, fourth, provide important insights into the effectiveness of quality programs. Including assessment results in the other technical areas as part of assessment deliberations in the quality programs and administrative controls area would reduce the subjectivity inherent in assessing a utility's performance in that technical area.

Recommendations

To enhance the effectiveness of NRC's program for periodically assessing the performance of utilities that operate nuclear power plants, we recommend that the Chairman, NRC,

- establish assessment-related criteria that, when met, would require the agency to either mandate a utility management improvement program or document the reasons why such a program is not warranted;
- routinely analyze historical assessment results and discuss marginal and declining performance trends in individual assessment reports;
- expand the information considered in periodic assessments to include readily available data on trends in nuclear power plant operating performance; and
- include in the agency's assessment deliberations on a utility's quality program and administrative controls performance the results of its assessments in the other nine technical areas.

Agency Comments and Our Evaluation

In its November 19, 1985, comments on a draft of this report (see app. IV), NRC stated that the report highlights several areas in which further NRC work may be desirable. As a general comment, NRC stated that it has started to move beyond a power plant inspection philosophy based on meeting minimum regulatory requirements and has begun to carry out inspections of management, maintenance, and training that reflect this change. It also provided additional information on several recent efforts by its Office for Analysis and Evaluation of Operational Data to collect, analyze, and make available to power plant assessment staff certain types of operations-related power plant data. We have expanded the report to include this additional information.

NRC's comments indicate that it recognizes its power plant inspections, assessments, and utility management improvement efforts can be strengthened. Our report focuses primarily on the latter two parts of NRC's operating power plant program. NRC's comments do not specifically address the report's recommendations to improve these activities, nor do they specify what other actions NRC plans to take to strengthen its programs. Because of the increasing number of operating nuclear power plants and the important impact NRC's assessment and improvement efforts can have on the quality of utility activities at these facilities, we believe NRC should commit itself to making the specific improvements in these areas that this report recommends.

Operating Nuclear Power Stations Required to Implement Facility-Wide Improvement Programs

Facility	NRC region	Date of NRC requirement	Reason for requirement
Palisades	3	3/09/81	Serious personnel error after minimally acceptable 1980 assessment ratings and history of inspection violations.
D.C. Cook	3	8/04/81	Recent personnel errors and missed surveillance tests indicating overall management control weaknesses.
Pilgrim	1	1/18/82	30 months of management errors concerning maintenance, redesign, and modification of an accident-mitigation system.
La Crosse	3	4/01/82	Recent inspection violations and 1980-81 assessment ratings indicating need for increased attention to plant procedures.
Duane Arnold	3	6/04/82	Quality assurance inspection violations for failure to (1) conduct certain required audits, (2) notify management of audit results, and (3) review the overall effectiveness of the quality assurance program.
Cooper	4	8/09/82	Material false statements concerning installation and readiness of an emergency prompt public notification system.
Brunswick	2	12/22/82	Event revealing operation for more than 7 years without conducting safety system surveillance tests.
Davis-Besse	3	11/04/83	General NRC concern with effectiveness of management controls and corrective action programs.
Nine Mile Point	1	3/20/84	Violations for (1) inadequate monitoring of plant conditions, (2) ten years of missed surveillance tests, and (3) not closing a reactor building door.
Turkey Point	2	7/11/84	Continuing violations of NRC requirements despite utility efforts to improve a marginal operations assessment in 1983.
Browns Ferry	2	7/11/84	3-1/2 years of marginal assessments in at least one-half of the areas evaluated.
Fort St. Vrain	4	11/14/84 ^a	Safety equipment failure during a reactor shutdown and 2 years of minimally acceptable operations assessments, with two minimal ratings in current report.

^aUtility initiated a facility-wide improvement program after a special NRC evaluation of facility restart and operation issues and a third-party assessment, required by NRC, of utility management.

Case Studies of the Operating History at Four Nuclear Facilities

We reviewed the history of four nuclear power stations where seven nuclear plants are located. The stations had experienced serious operational problems over several years and, as a result, had taken major action to upgrade their management and technical performance. Three of the four operating utilities implemented the management improvement programs at NRC's direction after extended periods of marginal performance; the remaining utility voluntarily instituted its program after NRC had determined that the operations of the nuclear plant station needed upgrading.

Our case studies addressed indicators of regulatory and operational performance such as the systematic assessment ratings, inspection violations detected by NRC, the plant incidents reported to NRC by the utilities, and the number of times the automatic safety protection systems were activated during plant operations. We supplemented our case studies with information obtained from NRC regional and headquarters officials responsible for oversight of these plants.

The case studies illustrate that implementation of the improvement programs has resulted in greater involvement by utility management in the operation of the plants, and better communication between NRC and utility officials regarding the needs and requirements of the facilities. In two instances, according to NRC, both regulatory and operational performance improved. According to NRC, continuing improvement is needed at one facility. For the remaining facility increased involvement by utility management led it to conclude that extensive changes were needed before continued safe operation could occur. Therefore, the utility shut down its plants until the necessary modifications could be put in place. All four case studies show, however, that the management improvement programs were put in place after protracted marginal performance at each station.

Maine Yankee

The Maine Yankee nuclear power station is located near Bath, Maine, and received its commercial operating license in December 1972. The station consists of one pressurized water reactor with an output of 810 megawatts and is the only nuclear facility operated by the Maine Yankee Atomic Power Company.

**NRC Assessments Showed
That Improvements Were
Needed**

On September 15, 1981, NRC reported the results of its systematic assessment for the period July 1980 to June 1981. The report noted that the utility had received 13 NRC inspection violations, including one in the quality assurance area. During the next assessment period (July 1981 to July 1982), however, the utility received 23 inspection violations including ten related to quality assurance. According to the assessment report, the utility appeared "reluctant to . . . use established QA [quality assurance] procedures as a working system . . ." and

"by failing to use established QA procedures, errors are made regarding the omission of verification of outstanding items or documentation of a problem The regular frequency of failure to document and the resulting potential to not inform cognizant management or to overlook a required reanalysis of safety related criteria, together with the inexperienced site staff, is a significant QA shortcoming."

NRC gave the utility a category 3 (minimally acceptable) rating in this area, which indicated that greater emphasis on this function was needed by both NRC and the utility.

Corrective Action Taken

As a result of the increasing number of NRC inspection violations and poor assessment results, the utility developed the Maine Yankee Quality Improvement Program. The program was a 2-1/2-year effort, beginning in August 1982, to enhance operational safety and effectiveness, better meet regulatory standards, and use personnel resources more efficiently. The program consisted of three broad areas—management controls, organizational effectiveness, and operational facilities—and targeted 59 specific improvement items that would be pursued to upgrade these areas. Because management controls had been identified as needing the greatest attention, the utility (1) established a management committee to review control systems and suggest improvements and (2) created a position responsible for directing, supervising, and coordinating on-site quality assurance activities. The improvement program was formulated on the basis of recommendations from independent consultants, NRC inspections and comments, and internal company suggestions.

**Some Improvement
Evidenced**

The 1983 NRC assessment (covering the period from July 1982 to June 1983) led NRC to conclude, on the basis of three quality assurance-related inspection violations, that Maine Yankee had made improvements in the area of quality assurance. According to NRC, the utility's

efforts to detect and correct errors before they became problems demonstrated heightened management commitment to the facility and improved its performance. In addition, since the implementation of Maine Yankee's quality improvement program, the facility's overall systematic assessment results have continued to improve.

Assessment Patterns Indicate the Need for Continuing Attention in One Area

When compared with the history of systematic assessments for the three other utilities included in our case studies, the patterns at the Maine Yankee facility are generally favorable in all categories except one, plant operations—which evaluates the day-to-day activities of the personnel operating the plant. Although the utility's quality improvement program was oriented toward improving this aspect of the station operation, as highlighted below, the facility has continued to receive a minimally acceptable performance assessment in this technical area. This ongoing trend should call attention to the continuing need for NRC and the utility to direct efforts to improve the performance of the plant staff in this category.

The utility has demonstrated its ability to respond with corrective action, as evidenced by the improvements in the refueling category. As highlighted below, during its first systematic assessment, Maine Yankee received a 3 in this category; the following evaluation saw an improvement in this category to a 1 rating, and the utility has been able to maintain this high rating in every subsequent evaluation that assessed this category.

Table II.1: Maine Yankee Assessment Results

Evaluation category	Systematic assessment period				
	Sept. 1979 to Aug. 1980	July 1980 to June 1981	Aug. 1981 to July 1982	July 1982 to June 1983	July 1983 to June 1984
Plant operations	2	2	3	3	3
Radiological controls	2	2	2	2	2
Maintenance	2	2	2	2	2
Surveillance	2	1	2	2	2
Fire protection	2	1	1	1	2
Emergency preparedness	2	1	2	2	1
Security	2	3	2	2	1
Refueling	3	1	^a	1	1
Quality programs and administrative controls	3	2	3	2	^a
Licensing activities	^a	^a	2	2	2

^aNot rated.

Pilgrim

The Pilgrim nuclear station is located in Plymouth, Massachusetts, and has been licensed for operation since September 1972. This single boiling water reactor-type plant produces 670 megawatts of electricity. The station, which is operated by the Boston Edison Company, is the utility's only nuclear unit.

Incidents Disclose the Need for Improvements

Beginning in 1972, three conditions at Pilgrim led NRC to conclude that serious deficiencies existed in the utility's management control of certain safety-related activities. The first involved the company's noncompliance with regulations governing the control of combustible gases in the event of potential accidents. The second involved the violation of technical specifications, demonstrated through NRC inspections that showed improper control of maintenance activities regarding safety-related electrical power supplies. This condition reduced assurance that certain safety equipment would function properly in the event of an emergency or accident. The third condition involved the operation of the facility at various times between 1972 and 1981, when the utility had knowingly exceeded certain temperatures while operating the plant.

Between June and October 1981, NRC performed eight inspections that identified 45 violations. The violations covered a wide range of utility functions, including maintenance, plant operations, emergency preparedness, and management controls. On the basis of one special comprehensive inspection, NRC found that utility management personnel were lacking in knowledge and understanding of the extent of their quality assurance program responsibilities and that management exercised limited oversight and involvement in this area. NRC determined that the utility gave insufficient review and attention to the Pilgrim facility's operation.

When inspections and incidents occurring after the comprehensive inspection continued to indicate weaknesses in the plant's operation, NRC imposed a \$550,000 civil penalty on the utility and required it to develop and implement, following NRC review and approval, a performance improvement program.

Utility Responds With Program to Enhance Management Commitment

On March 18, 1982, Boston Edison submitted its proposed performance improvement program to NRC. The program outlined an 18- to 24-month effort covering (1) an independent appraisal of site and corporate organizations and functions, (2) changes in organizational structure, (3) improvements in management control and oversight systems, and

(4) programs designed to improve individual performance. The program, accepted by NRC 1 month later, committed the utility to implementing 126 measurable actions by prescribed dates.

As a result of these initiatives, the company obtained a commitment from utilities operating similar nuclear plants to participate in a peer group to review and comment on the appraisal to be provided by an independent consultant. All nuclear activities were reassigned to a newly created unit. The unit was headed by a senior vice-president whose sole responsibility was management of the nuclear power plant. In addition, the position, director of nuclear operations, was created to provide corporate oversight of the safety-related activities at the plant. The director also makes recommendations to corporate management regarding perceived or potential operational problems. The company's training program was improved to assure that operating personnel take advantage of training opportunities. The training group was expanded into a department, a training manager was hired, an increase in the training staff was authorized, and the scope of the training program for both licensed and nonlicensed personnel was expanded.

NRC Notes Improvement but Continuing Program Emphasis Is Needed

On the basis of our analysis of assessment ratings since the improvement program began, NRC believes that the utility's performance has improved. The 1983 assessment report stated that

“further implementation of the Performance Improvement program and organization realignments continued to direct the licensee's resources, as well as expanding the resource base, in a manner that continues the trend toward improvement noted in the prior SALP (Systematic Assessment of Licensee Performance) report.”

An incident occurred and was reported to NRC in August 1984, however, which led NRC to conclude that problems continued to exist at the facility in the area of radiological controls. According to NRC,

“these occurrences at the facility represent inadequate planning, supervision and control of activities involving the potential for personnel exposure to radiation in excess of regulatory limits. These occurrences are indicative of programmatic deficiencies in the radiological controls program and they demonstrate the need for effective corrective measures to prevent similar occurrences in the future.”

NRC fined the utility \$40,000.

In a subsequent meeting between utility management and NRC, the utility acknowledged the need for corrective action, made additional commitments to improve, and proposed to hire a contractor to assess the utility's radiological control program. On November 29, 1984, NRC accepted these commitments through a confirmatory order that stipulated schedules and reporting requirements for the utility to meet. The order requires all actions and improvements to be in place by December 30, 1985.

According to NRC's Region I branch chief responsible for quality assurance inspections, the most significant lesson to be learned from this example is that special initiatives are needed to correct identified weak areas at nuclear power plants. The root cause of the operating deficiencies that existed for years was inadequate utility management control of plant operation and organization. Because no two utilities are alike, the identical improvement program probably could not be required at all plants; in certain instances, however, similar techniques to strengthen identified weaknesses at other utilities could be applied. For example, the basic framework of the Pilgrim improvement program has been provided to another NRC region for adaptation at a plant experiencing similar difficulties.

Systematic Assessments
Indicate the Need for
Further Improvement

On the basis of NRC's systematic assessments, the Pilgrim facility has demonstrated an ability to improve its performance but has encountered some difficulty in maintaining that level of improvement. As shown by the plant's assessment history in table II.2, during its first evaluation, the utility received a rating of 3 in the category of emergency preparedness; in the subsequent evaluation period, the utility evidenced improvements that earned it a rating of 1, which was maintained for the next two evaluations. During the most recent evaluation, however, which has been highlighted for the period ending in September 1984, the utility once again received a rating of 3 in this category.

Similar performance, although not as dramatic, has been evidenced in the category of radiological controls. In the first NRC assessment of Pilgrim, NRC gave the facility a rating of 3 in this category. The next three evaluations saw the plant improve and maintain a rating of 2; during the most recent evaluation period, however, the plant fell again to a rating of 3.

In another technical assessment area that has been highlighted—quality programs and administrative controls—the plant received consecutive

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ratings of 3 for the two assessment periods between January 1980 and August 1981; NRC, however, has not subsequently rated the facility in this category. This should call attention to the fact that NRC and the utility need to place particular emphasis on improving in this category.

Table II.2: Pilgrim Assessment Results

Evaluation category	Systematic assessment period				
	Jan. 1980 to Dec. 1980	Sept. 1980 to Aug. 1981	Sept. 1981 to June 1982	July 1982 to June 1983	July 1983 to Sept. 1984
Plant operations	2	3	3	2	2
Radiological controls	3	2	2	2	3
Maintenance	2	3	2	2	1
Surveillance	2	2	2	1	1
Fire protection	2	2	3	1	2
Emergency preparedness	3	1	1	1	3
Security	2	2	2	2	2
Refueling	3	2	2	^a	1
Quality programs and administrative controls	3	3	^a	^a	^a
Licensing activities	^a	^a	2	1	1

^aNot rated.

Brunswick

The Brunswick nuclear power station is located at Southport, North Carolina, and is operated by the Carolina Power and Light Company. The station consists of two 790-megawatt nuclear units that received operating licenses in December 1974 and September 1976, respectively. The utility operates one other nuclear plant at another location and is constructing a fourth nuclear plant.

Inspections and Evaluations Indicate Operational Problems

The Brunswick facility has experienced low NRC assessment ratings, inspection violations, civil penalties, and other conditions that indicate a history of operational problems. In its assessment for the 18-month period ending December 1981, NRC reported no significant weaknesses in the surveillance category and gave the utility an acceptable performance rating in this area. Six months later, however, an inspection performed by the utility in response to an incident at the plant disclosed that several periodically required surveillance tests had not been conducted. NRC subsequently inspected the facility and confirmed the utility's findings. NRC also noted additional problem areas, including the utility's failure to perform routine inspections of equipment such as

pumps, valves, switches, and calibration of instruments. NRC characterized these problems as major programmatic breakdowns caused by a breakdown in corporate and facility controls. According to an NRC Region II official, neither the utility nor NRC had detected these violations of regulatory requirements that had existed at both units since they began operating—about 8 years for one unit and 6 years for the other.

In February 1983 NRC imposed a \$600,000 fine on the utility for these violations (fines of \$120,000 and \$40,000 had been imposed by NRC during the previous year). NRC also pointed out examples illustrating the need for increased utility management attention to station operation. Particularly important to NRC was the fact that although the utility had discovered the surveillance problems at one unit, it had not recognized that the same surveillance requirements had also not been met at the other unit. As a result, the company had continued to operate the second plant in violation of its technical specifications. This led NRC to conclude that the utility's actions to resolve technical issues frequently lacked sufficient scope.

NRC Orders Improvements

In December 1982 NRC ordered the utility to implement a program to achieve basic improvements in management, operations, and quality assurance at the Brunswick station. The company conducted a comprehensive self-appraisal of its needs and identified a wide range of improvements that would be implemented through what it called a Brunswick Improvement Program. Although the program was oriented to the needs of the Brunswick station, the utility stated that, where applicable, it planned to apply the principles and lessons learned to its other nuclear station.

The quality improvement program was designed to provide the utility with a vehicle to (1) ensure safety and operating efficiency at the plant, (2) strengthen management control, (3) reinforce discipline of operations, procedural compliance, and regulatory sensitivity, (4) focus attention and resources on long-term needs, and (5) ensure implementation of other specific improvements. In conjunction with this effort, the company reorganized its operations and made a senior vice-president responsible for all nuclear operations. In addition, the utility assigned another vice-president to the Brunswick station to provide the necessary executive level of attention. Personnel at Brunswick and at the utility's other nuclear plant were also reorganized to ensure increased

communication between the sites and the corporate office and to provide increased on-site authority.

**NRC Finds That
Performance Has Improved**

According to the most recent NRC assessment report, changes have occurred at the two plants indicating that the utility is making significant improvement. NRC found that the improvement program has been effective in reducing deficiencies in plant operations and management. The company reorganization has allowed it to handle problems more quickly and effectively.

The improved facility performance is also evidenced by other indicators. Since implementation of the improvement program, the number of inspection violations detected by NRC has dropped from 64 in 1982 to 17 in 1984. In addition, the number of times the automatic safety protection systems of the plants were activated also decreased from 15 times in 1982 to 4 times between January and October 1984. NRC's most recent systematic assessment also indicates improvement in the areas of plant operations, refueling operations, maintenance, surveillance, quality assurance, and licensing activities.

**Systematic Assessments
Illustrate Ability to
Maintain Improvements**

As highlighted in table II.3, during its second and third evaluations covering the period between July 1980 and January 1983, Brunswick received consecutive ratings of 3 (minimally acceptable) in four technical areas—plant operations, maintenance, fire protection, and quality programs and administrative controls. On the basis of the assessment report for the period ending April 1984, however, the utility's improvement program appears to have had a favorable impact on the operation of the facility. Improvements have occurred in each of the four technical areas, and no category has been rated lower than 2.

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Table II.3: Brunswick Assessment Results

Evaluation category	Systematic assessment period			
	Apr. 1979 to Mar. 1980	July 1980 to Dec. 1981	Jan. 1982 to Jan. 1983	Feb. 1983 to Apr. 1984
Plant operations	2	3	3	2
Radiological controls	3	3	2	1
Maintenance	2	3	3	2
Surveillance	2	2	3	2
Fire protection	2	3	3	2
Emergency preparedness	2	2	1	1
Security	2	2	1	1
Refueling	2	a	3	1
Quality programs and administrative controls	2	3	3	2
Licensing activities	a	a	3	2

^aNot rated.

Browns Ferry

The Browns Ferry nuclear power station is located near Athens, Alabama, and consists of three boiling water reactors operated by the Tennessee Valley Authority (TVA). Unit 1 received its operating license in June 1973, followed by the licensing of Unit 2 a year later and Unit 3 in July 1976. Each unit has a rated output of 1,065 megawatts of electricity. TVA is also licensed by NRC to operate two nuclear plants located near Chattanooga, Tennessee, and is constructing four more plants in two other locations.

Poor Operating History Indicates the Need for Improved Performance

Between 1981 and 1984, NRC identified 652 inspection violations and assessed over \$413,000 in civil penalties in connection with the utility's operation of the Browns Ferry station. The trends demonstrated in NRC's systematic assessments indicate that TVA was not taking vigorous action to correct the identified deficiencies. NRC expressed its concern to TVA management regarding the lack of attention given to the operation of the nuclear plants during 13 enforcement conferences and management meetings held between January 1983 and February 24, 1984.

NRC's systematic assessment for the 13-month period ending February 1984 noted that while the overall performance of the Browns Ferry facility was acceptable, major weaknesses required additional TVA management attention. NRC noted the following factors as contributing to the continuing problems at Browns Ferry:

- the lack of management attention to the identification of the root cause of problems and inadequate corrective action,
- filling key management positions with personnel having minimal experience in the operation of boiling water reactors,
- failure to develop procedures that ensure that regulatory requirements are met,
- weaknesses in employee training programs emphasizing the need for strict compliance with operating procedures and regulatory requirements, and
- the lack of an effective quality assurance program.

TVA Takes Steps to Improve Its Operations

After continued violations and conferences with NRC, TVA recognized the need to institute a plan to upgrade its operation of the Browns Ferry station. A January 24, 1984, letter from the station superintendent to the manager of TVA's nuclear power operations called for a wide range of changes and new approaches to the operation of the three units. In calling for reforms, the superintendent noted:

"Recent events at Browns Ferry have caused us to stop and reevaluate our position relative to management controls necessary to assure regulatory compliance. . . . We all feel that some positive, immediate action is required in order to elevate Browns Ferry's regulatory performance to the level consistent with the division policy of complete compliance. . . . In the past, we have established management control consisting of paper programs that address all possible deficiencies and provide for reviews of that paper by higher level personnel. As deficiencies have been identified, we have provided for more review at higher levels. We have created such a perfect paper program for assuring compliance that it cannot be implemented by the workers."

On January 23, 1984, TVA suspended its refueling activities at Browns Ferry Unit 3 to concentrate on reevaluating its management controls and training to achieve better compliance with NRC regulations. One week later, a meeting was held between TVA and NRC management to discuss TVA's ongoing activities and its proposals to upgrade its performance at Browns Ferry. In February 1984 a conference was held between TVA officials and NRC's regional administrator responsible for oversight of the Browns Ferry units. The regional administrator identified areas of immediate concern, including the lack of communication between operating personnel and other units within TVA's organization and ineffective application of resources at the nuclear power plants. The regional administrator noted that these and other concerns were typical

of those that had been identified by NRC during previous management meetings between NRC and TVA.

In response to these concerns, TVA developed a Regulatory Performance Improvement Plan that described actions and schedules to ensure the safe operation of the facility. According to an NRC official responsible for monitoring Browns Ferry's performance, the basic framework of the improvement plan was patterned after the improvement program developed by Carolina Power and Light for its Brunswick nuclear power plants (discussed earlier in this appendix).

TVA's performance improvement program was divided into two phases to gain better management control and provide individual accountability and establish an environment for continued improvement. The short-term objectives included initiatives to (1) increase the time available for plant supervisors to be involved in workplace activities, (2) increase employee awareness of their responsibilities to and accountability for strict adherence to regulatory requirements, (3) upgrade training and requalification of the reactor operators, and (4) reorganize the plant to achieve better management control of plant activities. Over the long term, TVA management committed itself to resolving the continuing deficiencies that had been discovered in the past, improving the interaction between the engineering staff and the staff operating the plants, streamlining the procurement process, and increasing its Office of Quality Assurance's direct involvement in field activities. TVA submitted major organizational changes considered necessary to improve its nuclear program to NRC on May 4, 1984. On July 11, 1984, NRC issued a confirmatory order that bound TVA to its commitments and implementation schedules and required periodic reporting by TVA on its progress in program implementation. According to the confirmatory order, TVA's commitments were responsive to NRC's concerns regarding the utility's poor history of regulatory compliance. Since its first submittal, TVA has offered six revisions of its improvement program to NRC for approval.

Problems Continue

After continuing problems, TVA decided to shut down all three nuclear units at Browns Ferry and subsequently suspended the operation of its other units outside Chattanooga. Contributing to TVA's decision to shut down the units was an NRC requirement, in place since 1979, that all utilities document that certain equipment in the plant would be able to continue operation in the harsh environment of an accident. Since TVA's slow progress in meeting these requirements has been accompanied by

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repeated operational and maintenance errors, the utility plans to concentrate on upgrading one unit at a time to meet all the necessary requirements before attempting to return it to service. TVA's decision to shut down these plants, we believe, demonstrates the ultimate test of a utility's commitment to safe operations.

**Systematic Assessments
Demonstrate the Need for
Continuing Utility and NRC
Attention to Many
Technical Areas**

In NRC's first systematic assessment of the Browns Ferry facility, covering the period April 1979 to March 1980, NRC assigned the facility a rating of 3 (minimally acceptable) in the categories of radiological controls and quality programs and administrative controls. As highlighted in table II.4, these technical areas have received this rating by NRC for all subsequent evaluations. As highlighted below, slippages in performance were also evidenced in other categories during the next three evaluation periods ending in February 1984. The most dramatic change occurred in the refueling category, which declined from a rating of 1 in the third evaluation to 3 in the most recent. As noted earlier, continuing problems in meeting NRC requirements contributed to the decision to suspend operation of the Browns Ferry units until the necessary improvements could be made.

Table II.4: Browns Ferry Assessment Results

Evaluation category	Systematic assessment period			
	Apr. 1979 to Mar. 1980	July 1980 to June 1981	July 1981 to Dec. 1982	Jan. 1983 to Feb. 1984
Plant operations	2	3	3	3
Radiological controls	3	3	3	3
Maintenance	2	2	3	3
Surveillance	2	2	2	2
Fire protection	2	3	2	^a
Emergency preparedness	2	^a	2	2
Security	2	2	3	3
Refueling	2	2	1	3
Quality programs and administrative controls	3	3	3	3
Licensing activities	^a	^a	2	2

^aNot rated.

Utilities Included in GAO's Review

Utility	Nuclear Station
Duke Power Company	Catawaba Unit 1 ^a
Pennsylvania Power and Light Company	Susquehanna Units 1 and 2 ^a
Florida Power and Light Company	St. Lucie Units 1 and 2 Turkey Point Units 3 and 4
Carolina Power and Light Company	Brunswick Units 1 and 2
Boston Edison Company	Plymouth
Maine Yankee Atomic Power Company	Maine Yankee
Tennessee Valley Authority	Browns Ferry Units 1, 2, and 3 Watts Bar Units 1 and 2
South Carolina Electric and Gas Company	Summer Unit 1 ^a
Philadelphia Electric Company	Peach Bottom Unit 2 ^a

^aGAO representatives accompanied NRC inspectors on quality assurance program inspections.

Advance Comments From the Nuclear Regulatory Commission



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

November 19, 1985

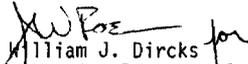
Mr. J. Dexter Peach, Director
Resources, Community, and Economic
Development Division
U.S. General Accounting Office
441 G. Street, N.W.
Washington, D.C. 20548

Dear Mr. Peach:

We appreciate the opportunity to comment on the draft GAO report, "Improved Regulatory Oversight Needed for Quality Assurance at Operating Nuclear Power Plants." The report makes several points which are useful to the Nuclear Regulatory Commission and highlights several areas in which we agree that further work by NRC may be desirable. As we move beyond a philosophy based on compliance with minimum regulations, we have begun to carry out inspections in the areas of management, maintenance and training. A report of such a recent inspection at Turkey Point is attached as Enclosure 1. We hope that this redirection of emphasis will lead to a further improvement in safety at nuclear plants.

With regard to the use of operational data in the SALP process, a number of activities have been underway for sometime but are not currently reflected in the draft report. Enclosure 2 is a description of several of these activities. The inclusion of these activities in the draft GAO report would serve to update and provide perspective to the report. We have no other specific comments on the content of this draft GAO report.

Sincerely,


William J. Dircks for
Executive Director for Operations

Enclosure:
As Stated

Now on p. 30

Suggested Addition

The following insert would update the draft report. This insert could be placed after the first full paragraph on page 35:

The NRC's Office for Analysis and Evaluation of Operational Data collects, assesses, and distributes data, including statistical measures of licensee performance. Recent activities in this regard include:

- o The Licensee Event Report System was modified through adoption of a new rule, 50.73, which was effective January 1, 1984. The new LER rule, for the first time, places uniform reporting requirements on all nuclear power plants and assures that events of interest, such as actuations of all engineered safety features, will be reported to the NRC. Thus data, which was not previously readily available, now exists to track the operational experience of each plant on a defined and consistent base.
- o AEOD analyzes the trends and patterns of individual plant performance as well as that of the industry. Included in this activity are performance indicators based upon operational data. Two major studies in this regard have been produced; one study covers the scram history of all plants during 1984, and the other study covers the actuation of Engineered Safety Features (ESF) equipment for the first six months of 1984. These studies have been distributed to the staff and are intended for use as input into the SALP Program. These studies are the first in a series of reports on scrams and ESF actuations. Subsequent reports will also consider the trends in these measures of licensee performance. AEOD also has in progress studies which will provide statistical measures associated with safety system availability and technical specification violations.
- o As another specific measure of plant performance, AEOD is implementing a quantitative program to assess the quality of Licensee Event Reports prepared by licensees. This program provides a summary of the strengths and weaknesses of LERs from individual plants and then provides a summary of all plants. This data is also being routinely provided to each region as input to SALP determinations.

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A handwritten signature or set of initials, possibly 'JL', written in dark ink. The signature is stylized and cursive, with a large loop on the left side and a long, sweeping tail on the right.